Pinna Nobilis as a proxy to good environmental status: stable isotope signatures under a gradient of eutrophication and protection

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Pinna nobilis is an endangered large bivalve mollusc endemic to the Mediterranean. It is a fast growing organism: during the first two years it has a high growth rate and can measure up to 65 cm long in years 12-15. This bivalve lives one-third buried in soft substrata, usually in seagrass meadows, and is an efficient filter feeder, assimilating both carbon and nitrogen derived compounds in its tissues, especially in muscle tissues, from its food sources. The fan mussel is therefore a good bioindicator of water quality and hence of the inhabiting area. ^{13}C and ^{15}N isotopic signatures of muscle tissues were used to demonstrate isotopic variation amongst *P.nobilis* individuals sampled inside three marine protected areas (Santa María, Dragonera and Espardell) and outside protected areas (Magaluf, Andratx and Esponja) of the Balearic Islands, western Mediterranean. Samples of *P.nobilis* were obtained throughout 2011 from Santa María, Magaluf and Andratx sites and published data of isotopic signatures of *P.nobilis* muscles tissues from Dragonera, Espardell and Esponja sites (Cabanellas-Reboredo . 2009) were incorporated into this study. Further on, nutrients concentration values from the sampling sites were also quantified. A statistical analysis based on a permutational analysis of variance (PERMANOVA) was carried out to study significant differences between isotopic signatures values of individuals from the six studied sites. Individuals sampled outside marine protected areas have higher ^{13}C and ^{15}N isotopic signals in their muscle tissues than those inside these areas. *P.nobilis* individuals from Magaluf had the highest mean carbon and nitrogen isotopic values, -18,63 ± 0,17‰ and 5,77 ± 0,23‰ respectively while individuals sampled inside the National Park of Cabrera, Santa Maria site, had the lowest mean carbon and nitrogen isotopic values, -19,35 ± 0,44‰ and 3,01 ± 0,25‰ respectively. Environmental differences such as light intensity, nutrient concentrations and species composition affect $\delta^{13}C$ and $\delta^{15}N$ values of primary producers in a region, so populations from different geographic locations show dissimilar isotopic signatures, even if they have similar diets. Organisms living in areas with high nutrient loads and no fisheries protection present higher isotopic signatures reflecting a more anthropogenic environment. This study can be used to reflect the importance of filter feeder bivalves such as *P.nobilis* as good bioaccumulators, giving us information about the surrounding environmental conditions and therefore helping to asses the good environmental status of littoral ecosystems.

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